DOCUMENT RESUME

ED 142 130 HE 009 120

TITLE	Science Resources Studies Highlights. Academic R & D Expenditures Up 9 Percent in FY 1976.
INSTITUTION	National Science Foundation, Washington, D.C. Div. of Science Resources Studies.
REPORT NO	NSF-77-314
PUB DATE	Jul 77
NOTE	5p.; Tables may not reproduce well
AVAILABLE FROM	National Science Foundation, 1800 G St. N.W., Washington, D.C. 20550
EDRS PRICE	MF-$0.83 HC-$1.67 Plus Postage.
DESCRIPTORS	*Colleges; Engineering; Environmental Research; *Expenditures; *Federal Aid; Financial Support; Higher Education; Mathematics; Psychology; *Research; *Scientific Research; *Universities

ABSTRACT

The preliminary findings of the National Science Foundation's survey of scientific and engineering expenditures at universities and colleges for FY 1976 reveal that: (1) research and development (R & D) expenditures totaled $3.7 billion, a nine percent increase over the previous year; after discounting inflationary effects, this represents a real-dollar growth of two percent, the same growth as in 1975; (2) federal agencies continued to sponsor two-thirds of academic R&D activities, although constant-dollar increases in nonfederal spending outpaced federal growth; (3) basic research expenditures rose five percent to $2.5 billion and accounted for 68 percent of all academic R&D activities in 1976; this portion has declined from 77 percent in 1970; and (4) the most rapid current-dollar growth in major scientific disciplines occurred in engineering and the physical and environmental sciences; activities in mathematics and psychology actually decreased. (Author/MSE)

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SCIENCE RESOURCES STUDIES **HIGHLIGHTS**

SCIENCE FOUNDATION • WASHINGTON, D. C. 20550 • July 5, 1977 • NSF 77-314

Academic R&D Expenditures Up 9 Percent In FY 1976

This report contains the preliminary findings of NSF's Survey of Scientific and Engineering Expenditures at Universities and Colleges, FY 1976. The survey was mailed to all graduate-degree-granting institutions and all others that spent $50,000 or more for R&D activities. Estimates for nonrespondent institutions represent less than 6 percent of total R&D expenditures.

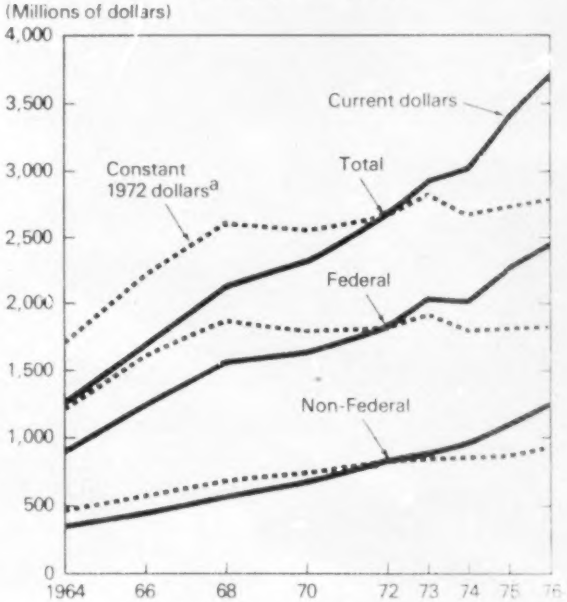
- Separately budget R&D expenditures at universities and colleges totaled $3.7 billion in 1976, a 9-percent increase over 1975 spending levels. After discounting inflationary effects, R&D expenditures rose 2 percent, repeating the 1975 real-dollar growth.[1]
- Federal agencies continued to sponsor two-thirds, or $2.5 billion, of academic R&D activities. Constant-dollar increases in non-Federal spending in 1976, 6 percent, outpaced Federal growth, 1 percent. Most of this non-Federal surge was due to an increase in State and institutional funds.
- Basic research expenditures rose 5 percent to $2.5 billion and accounted for 68 percent of all academic R&D activities in 1976. This portion has declined from 77 percent since 1970. Combined applied research and development spending rose from a 23-percent share to 32 percent during this period.
- The most rapid current-dollar growth in major scientific disciplines occurred in engineering, up 16 percent, and both the physical and environmental sciences where R&D activities expanded 11 percent over 1975. However, mathematics and psychology actually decreased 2 percent and 8 percent, respectively. Average real R&D growth rates have ranged from 15 percent in the environmental sciences to 2 percent in the mathematical sciences since 1970.

Source of Support

Federal and non-Federal R&D support at institutions of higher education increased in both current and constant dollars in 1976. Federally financed R&D expenditures totaled $2.5 billion, an increase of 7 percent from 1975, while non-Federal R&D support totaled nearly $1.3 billion, up 13 percent. When measured in constant dollars the growth in non-Federal R&D support, 6 percent, exceeded increases in Federal funding, 1 percent, although Federal agencies continued to support two-thirds of all academic R&D programs. Real-dollar growth rates from non-Federal sources ranged from an 11-percent rise in institutional funds to a 3-percent increase in combined State and local support. Most of the non-Federal increase in 1976 was provided by State and institutional funds.

The growth of R&D expenditures, fueled by strong Federal support, accelerated rapidly during the early sixties. Near the end of this decade increases in Federal R&D support began to wane, causing schools to turn to other sources of R&D funds. In fact, during the seventies, constant-dollar R&D growth at academic institutions has been largely provided by non-Federal sources. For example, the constant-dollar level of Federal R&D funding increased only 2 percent between 1970 and 1976.

Chart 1. R&D expenditures at universities and colleges: FY 1964-76



[a]Based on GNP implicit price deflator.
SOURCE: National Science Foundation

[1] In the absence of a reliable R&D cost index, the gross national product (GNP) implicit price deflator was used to convert R&D expenditures to constant dollars.

(Prepared in the Universities and Nonprofit Institutions Studies Group, Division of Science Resources Studies.)

while non-Federal funding was 25 percent higher. State and institutional funds provided most of the increases in non-Federal R&D support during this period (Chart 1).

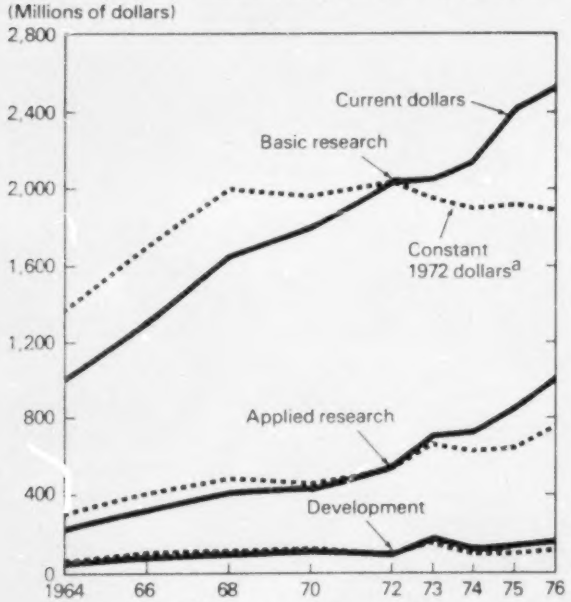
Character of Work

Over one-half—53 percent—of the U.S. basic research effort continued to be performed in universities and colleges in 1976. This level has remained relatively constant during the last 6 years. Academic spending for basic research totaled $2.5 billion, up 5 percent from 1975.

Approximately 68 percent of all academic R&D funds were designated for basic research projects. However, this level has gradually declined since 1970 when 77 percent of academic R&D spending was classified as basic research. In contrast, applied research, $1.0 billion, now represents 27 percent of total academic R&D spending, up from 18 percent in 1970. Development expenditures have remained constant at about 5 percent since 1970.

When measured in constant dollars, basic research expenditures have declined at an average rate of 1 percent per year during the last 8 years, so that academic basic research funds in 1976 were 5 percent below 1968, the peak year. Applied research rose at an average annual rate of 6 percent between 1968 and 1976. Most of this constant-dollar growth in applied research was due to an 8-percent per year growth in non-Federal support, twice the average yearly growth of Federal funds (Chart 2).

Chart 2. R&D expenditures at universities and colleges by character of work: FY 1964-76



[a]Based on GNP implicit price deflator.
SOURCE: National Science Foundation

Fields of Science

R&D spending growth was reported in all but two of the major scientific disciplines between 1975 and 1976. Significant increases occurred in engineering, up 16 percent, and in both the physical and environmental sciences, up 11 percent each. Over one-half of all academic R&D activities continued to be concentrated in the life sciences, which increased 10 percent in 1976. In contrast, spending declines were reported in psychology, down 8 percent, and the mathematical sciences, down 2 percent.

Federal support was most apparent in the physical sciences where four-fifths of R&D expenditures were Federally financed. Nearly 75 percent of the R&D expenditures in psychology were sponsored by Federal funds. Non-Federal support was significant in the social sciences, accounting for 47 percent of R&D spending.

Federal support expanded in four scientific areas, with the largest percentage increase occurring in the environmental sciences, 17 percent; expenditures in psychology reflected the largest rate of decline, 10 percent. Changes in non-Federal funding patterns ranged from R&D growth of more than 20 percent each in engineering and the physical sciences to a decline of 2 percent in the environmental sciences.

Between 1970 and 1976, Federally funded R&D growth occurred at the fastest pace in the environmental sciences, at an average rate of 16 percent per year. Non-Federal R&D support expanded most rapidly in engineering, with an average annual growth rate of 13 percent since 1970 (Chart 3).

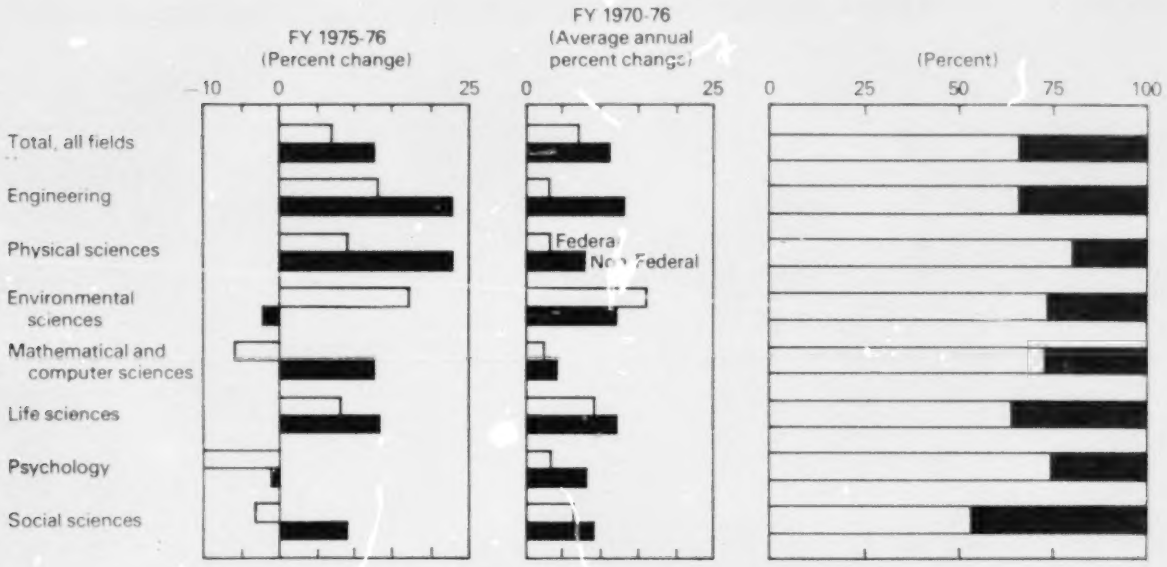
Type of Control

Public and private universities and colleges reported R&D spending increases of 10 percent and 8 percent, respectively. After discounting the effects of inflation, R&D spending in public schools rose 3 percent in 1976, compared to a rise of only 1 percent in private institutions. The growth in Federal R&D support was higher in the public sector, up 2 percent, than in the private sector, where there was a constant-dollar decline of 2 percent. Between 1970 and 1976 the average annual growth of R&D expenditures in public schools, 3 percent, contrasted sharply with the average decline of 1 percent per year in private institutions.

Twenty Leading Institutions

R&D expenditures continued to be highly concentrated within the 20 leading performers (11 of which were public); they accounted for 36 percent of total R&D spending and 39 percent of Federally financed funds. Since 1970 there has been little change in these concentration patterns. Non-Federally supported R&D spending was less concentrated, with the 20 leading institutions accounting for 29 percent of the total.

Chart 3. R&D expenditures at universities and colleges, by field and source: FY 1976



SOURCE: National Science Foundation

Twenty universities reporting the largest amounts of separately budgeted R&D expenditures: FY 1975-76

[Dollars in thousands]

Institution	Total R&D			Federal R&D		
	1975	1976	Percent change, 1975-76	1975	1976	Percent change, 1975-76
Total	$1,233,425	$1,324,189	7.4	$890,261	$959,042	7.7
1. University of Wisconsin-Madison	95,436	98,097	2.8	48,217	51,870	7.6
2. Massachusetts Institute of Technology	84,668	94,280	11.4	69,599	76,654	10.1
3. University of California-San Diego	76,898	82,257	7.0	69,032	73,741	6.8
4. University of Michigan	74,553	79,179	6.2	46,671	49,223	5.5
5. University of Minnesota	69,655	75,103	7.8	41,827	45,031	7.7
6. Stanford University	66,876	72,725	8.7	59,640	66,990	12.3
7. University of Washington	65,947	68,286	3.5	55,260	54,420	-1.5
8. University of California-Berkeley	65,087	67,986	4.5	46,648	48,916	4.9
9. Columbia University	68,197	67,006	-1.8	50,852	53,545	5.3
10. Cornell University	61,545	66,199	7.6	36,841	41,744	13.3
11. Harvard University	64,176	65,318	1.8	49,667	50,537	1.8
12. University of California-Los Angeles	57,833	62,793	8.6	47,326	51,327	8.5
13. University of Chicago	58,766	62,395	6.2	45,096	46,335	2.7
14. University of Pennsylvania	52,904	59,983	13.4	41,640	46,107	10.7
15. Johns Hopkins University	56,471	57,296	1.5	45,787	47,490	3.7
16. University of Illinois-Urbana	51,203	57,005	11.3	32,846	38,515	17.3
17. University of California-San Francisco	43,261	47,824	10.5	36,450	40,736	11.8
18. Texas A&M University	39,349	47,015	19.5	16,180	17,823	10.2
19. University of Texas at Austin	41,754	46,856	12.2	23,830	27,306	14.6
20. University of Rochester	38,848	46,586	19.9	26,852	30,732	14.5

SOURCE: National Science Foundation

Technical Notes

Data presented in this report refer to separately budgeted R&D expenditures. Capital expenditures and instructional and departmental research spending are treated separately in the survey. They are excluded here, but will be analyzed in the final report for the 1976 survey.

Questionnaires were mailed on October 29, 1976 to 540 universities and colleges. Based upon the results of wider surveys conducted in prior years, it has been determined that these institutions account for 99 percent of all academic R&D expenditures. Estimates were made for 15 percent of the institutions which had not responded to the survey by April 1, 1977, when preliminary tabulations were generated. These estimates amounted to less than 6 percent of total R&D spending. As these data are preliminary, they may be subject to small revisions prior to the release of future publications.

Summary of characteristics of separately budgeted R&D expenditures in the sciences and engineering in universities and colleges: FY 1967-76

[Dollars in millions]

	1964	1966	1968	1970	1972	1973	1974	1975	1976 1/
Total	$1,275	$1,715	$2,149	$2,335	$2,677	$2,940	$3,017	$3,405	$3,720
(In 1972 dollars) 2/	(1,733)	(2,230)	(2,611)	(2,569)	(2,677)	(2,816)	(2,679)	(2,726)	(2,791)
Source of funds:									
Federal Government	917	1,261	1,572	1,648	1,839	2,038	2,032	2,291	2,459
State and local governments	132	156	172	219	270	295	327	352	389
Foundations and voluntary health agencies	61	77	95	110	178	131	142	168	186
Industry	40	42	55	61	75	85	96	113	128
Other sources	21	32	36	55	59	70	76	90	107
Institutional funds	103	147	218	243	306	319	344	390	451
Character of work:									
Basic research	1,003	1,303	1,650	1,796	2,022	2,054	2,146	2,405	2,534
Applied research	232	328	404	427	544	717	737	851	1,019
Development	41	83	95	112	110	168	133	148	167
Field of science:									
Engineering	162	259	309	319	347	384	346	381	442
Physical sciences	217	287	320	307	330	330	333	350	390
Astronomy	16	23	24	19	22	24	24	27	28
Chemistry	70	88	105	102	110	114	116	121	142
Physics	120	159	173	162	162	167	169	173	190
Other physical sciences, nec	12	17	18	25	36	24	24	29	30
Environmental sciences	55	68	120	125	192	210	235	255	284
Mathematical sciences	33	42	58	72	71	75	77	85	84
Mathematics	NA	NA	NA	NA	NA	37	38	40	39
Computer sciences	NA	NA	NA	NA	NA	38	39	45	45
Life sciences	682	872	1,037	1,194	1,353	1,529	1,627	1,899	2,084
Biological sciences	315	422	491	547	682	822	4/510	605	713
Agricultural sciences	(3)	(3)	(3)	(3)	(3)	(3)	346	382	431
Medical sciences	320	390	477	549	605	646	714	841	866
Other life sciences, nec	46	60	69	98	65	51	57	72	73
Psychology	32	40	59	59	70	74	74	80	73
Social sciences	82	109	168	169	206	232	240	255	261
Other sciences, nec	14	37	77	89	107	106	84	100	102

1/ Preliminary.
2/ Based on GNP implicit price deflator.
3/ Included in biological sciences.
4/ Beginning in 1974 excludes agricultural sciences.

NOTE: Detail may not add to total because of rounding.

SOURCE: National Science Foundation

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